

## CLIMATE NARRATIVE, March 2020 and as noted

### UNITED STATES WEST COAST AND NORTH PACIFIC

During late March 2020, satellite **derived sea surface temperatures** (SST<sub>M</sub>) for US west coast (20-150 km offshore) showed positive SST<sub>M</sub> anomaly ( $\leq 2^{\circ}\text{C}$ ) in the California upwelling system between the upper Southern California Bight ( $34.3^{\circ}\text{N}$ ) and Point Arena ( $39^{\circ}\text{N}$ ). SST<sub>M</sub> was between  $10^{\circ}$ - $17^{\circ}\text{C}$  along this coastal strip. Negative SST<sub>M</sub> anomaly ( $\geq -2.0^{\circ}\text{C}$ ) in areas off Oregon extended as much as 500 km offshore and alongshore northwest into the Gulf of Alaska. West of coastal waters, an area of negative SST<sub>M</sub> anomaly extended westward off Mexico and California ( $20^{\circ}$ - $40^{\circ}\text{N}$ ) toward the Hawaiian Islands ( $150^{\circ}\text{W}$  at  $15^{\circ}$ - $25^{\circ}\text{N}$ ). West of the negative anomaly, an area of positive SST<sub>M</sub> anomaly ( $\leq 2.5^{\circ}\text{C}$ ), variable between  $25^{\circ}$ - $50^{\circ}\text{N}$ , was found across millions of  $\text{km}^2$  of the North Pacific from  $150^{\circ}\text{W}$  to the coasts of Japan at  $140^{\circ}\text{E}$ . Areas of weak to moderate positive SST<sub>M</sub> anomaly occurred between  $5^{\circ}\text{S}$ - $20^{\circ}\text{N}$  from  $135^{\circ}\text{W}$  to  $150^{\circ}\text{E}$ . Areal positions and SST anomaly magnitude may vary depending on sensors and

processing. <https://www.ospo.noaa.gov/Products/ocean/sst/anomaly/>  
[https://coastwatch.pfeg.noaa.gov/elnino/coastal\\_conditions.html](https://coastwatch.pfeg.noaa.gov/elnino/coastal_conditions.html) (current)  
<https://coastwatch.pfeg.noaa.gov> <https://climateanalyzer.org/wx/DailySummary/#sstanom> (current)  
<https://www.ospo.noaa.gov/Products/ocean/sst/contour/index.html>

March **Sea Level Height Anomaly** (SLA) analyses of the Pacific Ocean from the equator ( $0^{\circ}$ ) to  $40^{\circ}\text{N}$ , show negative SLA ( $\leq 15\text{ cm}$ ) along the coast of North America from  $25^{\circ}\text{N}$  north to beyond  $40^{\circ}\text{N}$ . This area extended more than 2,000 km to the west. Generally, the northeastern Pacific ( $75^{\circ}\text{W}$ - $180^{\circ}$ ) was characterized by equally large areas ( $\geq 2 \times 10^6\text{ km}^2$ ) of positive and negative SLA with elevation magnitudes less than 20 cm. An area of strong positive SLA off the west coast of southern Mexico and Central America appeared continuous with similar anomalies in the Gulf of Mexico. The western north Pacific, ( $180^{\circ}$  to  $120^{\circ}\text{E}$ ) had negative SLA south of  $20^{\circ}\text{N}$  and positive SLA to the north, with the northern area corresponding to areas of positive SST<sub>M</sub> anomaly.

[http://www.cpc.ncep.noaa.gov/products/analysis\\_monitoring/ocean/weeklyenso\\_clim\\_81-10/wksl\\_anm.gif](http://www.cpc.ncep.noaa.gov/products/analysis_monitoring/ocean/weeklyenso_clim_81-10/wksl_anm.gif) (current)

March satellite imagery of US west coast **chlorophyll-a** (chl-a) indicated an increase in coastal (50-100 km) chl-a concentrations. Between the Santa Barbara Channel ( $34^{\circ}\text{N}$ ) and Vancouver Island ( $50^{\circ}\text{N}$ ) surface chl-a of  $0.5$ - $2.5\text{ mg/m}^3$  marked filaments and eddies reaching 200-700 km offshore. Chl-a concentrations of  $2$ - $4\text{ mg/m}^3$  occurred locally inshore. Offshore water ( $\leq 0.2\text{ mg/m}^3$ ) entered the Southern California Bight from the south and southwest. Derived surface layer chl-a concentrations may vary depending on sensors and compositing techniques.

<https://coastwatch.pfeg.noaa.gov/coastwatch/CWBrowserWW180.jsp#>  
[https://coastwatch.pfeg.noaa.gov/erddap/griddap/erdVHNchla8dav\\_graph?chla\[\(2020-03-30T00:00:00Z\)\]\[\(0.0\)\]\[\(83.65125\);\(-0.10875\)\]\[\(-193.76625\);\(-110.00625\)\]&.draw=surface&.vars=longitude%7Clatitude%7Cchla&.colorBar=%7C%7C%7C%7C%7C%7C&.bgColor=0xffccccff](https://coastwatch.pfeg.noaa.gov/erddap/griddap/erdVHNchla8dav_graph?chla[(2020-03-30T00:00:00Z)][(0.0)][(83.65125);(-0.10875)][(-193.76625);(-110.00625)]&.draw=surface&.vars=longitude%7Clatitude%7Cchla&.colorBar=%7C%7C%7C%7C%7C%7C&.bgColor=0xffccccff)  
<https://www.star.nesdis.noaa.gov/sod/mech/color/> (current)

### Monthly sea temperature list from shore stations and near-shore buoys,

The following list gives shore and nearshore water temperature measurement locations in decreasing latitude. Each line begins with a shore station or buoy abbreviation followed by latitude. Temperature values are in brackets with the average of available monthly values first (followed by the range) in parens and change from previous monthly mean. Averages for the (first, second and third) third of the month (tercile), are within the second parens, followed by the multiyear monthly average, where

available. Subscripts H and L indicate the tercile that contains the Highest and Lowest monthly temperatures.

At Eel River buoy (EelR) and to the north there is little or negative change in average SST<sub>M</sub> from February to March and monthly SST<sub>M</sub> anomalies at the included buoys are negative. Locations sampled near Point Conception (PtCn) and northward have the highest temperature in the second or third tercile. In the Southern California Bight, including the Santa Barbara Channel (SBCh) the tercile position of temperature extremes during March appears more variable.

### List (March 2020)

#### Amphitrite Point, B.C. 48.9°N

Neah, 48.5°N, 124.7°W [8.2(7.6-9.3)-0.2(8.2<sub>H</sub>,8.0<sub>LH</sub>,8.4)8.7°C]

#### Cape Flattery 48.4°N

NeBy, 48.4°N [8.0(6.4-9.7)-0.3(7.9,7.7<sub>L</sub>,8.5<sub>H</sub>)°C]

CpEz, 47.4°N, 124.7°W [8.8(7.9-9.9) -0.3(8.6, 8.6<sub>LH</sub>,9.2<sub>H</sub>)9.3°C]

TIMk, 46°N, 125.8°W [9.3 (8.9-10.0)0.1(9.4<sub>L</sub>,9.2<sub>H</sub>,9.3<sub>H</sub>)10.2°C]

#### Cape Blanco 42.8°N

PrtO, 42.7°N [9.1(7.8-10.9)-0.1(8.8,8.8<sub>LH</sub>,9.7<sub>H</sub>)°C]

CCty, 41.7°N [9.8(8.7-11.7)-0.1(9.3<sub>L</sub>,9.4,10.7<sub>H</sub>)°C]

EelR, 40.7°N, 124.5°W [10.1(8.9-11.5)0.1(9.5<sub>L</sub>,10.1,10.7<sub>H</sub>)11.1°C]

#### Point Arena 39°N

ArCv, 38.9°N [11.2(9.6-13.7)1.1(10.2<sub>L</sub>,11.7,11.8<sub>H</sub>)°C]

#### Point Reyes 38°N

SFrn, 37.8°N, 122.8°W [12.3(10.8-14.3) 0.7(11.5<sub>L</sub>,12.4,13.0<sub>H</sub>)12.0°C]

Mtry, 36.6°N [14.2(13.0-15.9)1.0(13.6<sub>L</sub>,14.1,14.9<sub>H</sub>)°C]

PrtS, 35.1°N [14.7(13.6-15.6)1.2(14.4,14.8,14.8<sub>LH</sub>)°C]

PtCn, 34.5°N, 120.8°W [14.7 (13.8-15.8)0.5(14.4<sub>L</sub>,15.0<sub>H</sub>,14.7)°C]

#### Point Conception,34.4°N

SBCh, 34.3°N, 119.9°W [14.8 (13.3-16.2)-0.2(15.3<sub>H</sub>,14.7,14.3<sub>L</sub>)13.3°C]

Smca, 34°N [16.2(14.9-17.2)0.7(16.3<sub>H</sub>,16.1,16.1<sub>LH</sub>)°C]

Tory, 32.9°N, 177.4°W [15.0 (13.8-16.5) 0.5(14.9,15.1<sub>H</sub>,15.0<sub>L</sub>)°C]

LaJo, 32.9°N [16.2(14.5-17.3)0.8(16.1<sub>L</sub>,16.3,16.3<sub>LH</sub>)°C]

#### Point Loma, 32.7°N

Shore measurements, taken at a fixed depth below the lowest tide at NOAA **tide stations**, are indicated by: *NeBy* (9443090), *PrtO* ( 9431647), *CCty* (9419750), *ArCv* ( 9416841), *Mtry* (9413450 ), *PrtS* (9412110), *Smca* (9410840), and *LaJo* (9410230). (Numbers) lead to detailed location and station descriptions,

<https://tidesandcurrents.noaa.gov/stations.html?type=Physical%20Oceanography>

. Near shore buoy measurement details are obtained from number designations: Neah (46087 ), CpEz (46041), TIMk (46089), EelR (46022), SFrn (46026), PtCn (46218), SBCh (46053), [Try \(46225 \)](#). [https://www.ndbc.noaa.gov/station\\_page.php?station=46087](https://www.ndbc.noaa.gov/station_page.php?station=46087)

## **EQUATORIAL AND SOUTH PACIFIC** (late March and as noted)

Models predict with 55% probability that current El Niño-neutral conditions will persist into boreal summer. Weakly positive SST<sub>M</sub> anomaly ( $\leq 2^{\circ}\text{C}$ ) extended across the Equatorial Pacific (EP), with the highest anomalies persisting between 160°W and 160°E. Positive subsurface temperature anomalies ( $\leq 3^{\circ}\text{C}$ ) decreased intensity resulting in decreasing eastern EP upper 300 m heat content anomaly. Farther south, there was decreasing positive SST<sub>M</sub> anomaly between the date line and Australia, but a large area ( $\geq 10^6 \text{ km}^2$ ) of positive anomaly persisted in the eastern south Pacific between 30°-50°S and 140°-165 °W. Night-time satellite imagery indicated two areas ( $\geq 10^6 \text{ km}^2$ ) of negative SST<sub>M</sub> anomaly, one in the eastern south Pacific (10°-50°S, 110°-135°W) and an area of less intense anomaly south of New Zealand and Australia (180° to 130°E) extending beyond 65°S toward to the Antarctic ice edge. North and South eastern Pacific had similar SST<sub>M</sub> structures in that a V-shaped (vertex eastward) area of negative anomaly occurred between an offshore area of positive SST<sub>M</sub> anomaly and the continental coast.

<http://www.ospo.noaa.gov/Products/ocean/sst/anomaly/>

[https://www.cpc.ncep.noaa.gov/products/analysis\\_monitoring/lanina/enso\\_evolution-status-fcsts-web.pdf](https://www.cpc.ncep.noaa.gov/products/analysis_monitoring/lanina/enso_evolution-status-fcsts-web.pdf)

<https://www.ospo.noaa.gov/Products/index.html>

**Sea level height anomaly (SLA)** analyses of the south Pacific Ocean (0°-30°S) showed negative SLA ( $\geq -10 \text{ cm}$ ) along the South American west coast from 30°S to 7°N. This area ( $\geq 3 \times 10^6 \text{ km}^2$ ) extended westward to 110°W, 135°W and 165°W at equator (0°), 10°S and 20°S, respectively. In the central south Pacific positive SLA ( $\leq 20 \text{ cm}$ ) was found from an area from 135°W to the date line (180°), extending meridionally from 30°S to 5°S. West of 180°, negative anomaly extended to the coasts of Australia and New Guinea and was continuous northward from there to 20°N.

[http://www.cpc.ncep.noaa.gov/products/analysis\\_monitoring/ocean/weeklyenso\\_clim\\_81-10/wksl\\_anm.gif](http://www.cpc.ncep.noaa.gov/products/analysis_monitoring/ocean/weeklyenso_clim_81-10/wksl_anm.gif) (current)

The NOAA **Oceanic El Niño Index** (ONI) (3-month running mean of SST anomalies in the Niño 3.4 region) increased to 0.5 for October-November-December (OND), then remained at 0.5 through JFM giving four consecutive El Niño-like ONI values.

[http://www.cpc.ncep.noaa.gov/products/analysis\\_monitoring/lanina/enso\\_evolution-status-fcsts-web.pdf](http://www.cpc.ncep.noaa.gov/products/analysis_monitoring/lanina/enso_evolution-status-fcsts-web.pdf)

<https://climatedataguide.ucar.edu/climate-data/multivariate-enso-index> (alternate El Niño index)

The NOAA/NCEI **Pacific Decadal Oscillation Index** (PDO), calculated from Pacific Basin wide ERSST.v4 was -1.40 for January and -1.35 for February. Each of these values is lower than any calculated in 2019. SST<sub>M</sub> distributions suggest another negative value for March.

<https://www.ncdc.noaa.gov/teleconnections/pdo/> ,

<https://www.ospo.noaa.gov/data/sst/anomaly/2020/anomnight.3.30.2020.gif>

The Pacific / North American Teleconnection Index (PNA), computed from atmospheric pressure over the Pacific Ocean and North America, had near neutral daily values during February, but these became persistently negative in March, with monthly mean PNA of -2.17. <https://www.cpc.ncep.noaa.gov/data/teledoc/pna.shtml> (see computational alternatives).

March monthly ERD/SWFSC west coast Upwelling Indices (UI) were weakly positive between 24°-54°N. Neither upwelling nor downwelling appeared favored in the means. UI anomalies were weakly positive 39°-60°N and negative 27-36°N, suggesting southward displacement of eastward propagating seasonal low pressure systems.

<https://upwell.pfeg.noaa.gov/products/PFELData/upwell/monthly/table.2003> (change date)

Daily UI values for 36° were upwelling positive on the 1, 2, 3, 25 and 26 March and low magnitude positive and negative values for the other days of March.

<https://oceanwatch.pfeg.noaa.gov/products/PFELData/upwell/daily/p10dayac.all> (36°N)

<https://oceanwatch.pfeg.noaa.gov/products/PFELData/upwell/daily/p09dayac.all> (39°N)

<https://oceanwatch.pfeg.noaa.gov/products/PFELData/upwell/daily/p09dayac.all> (see computational alternatives)

<https://oceanview.pfeg.noaa.gov/products/upwelling/dnld> (current)

### **PRECIPITATION and RUNOFF (late March)**

Coastal Washington had rain during February and early March to bring precipitation totals near to seasonal averages for March. Southern Oregon and northern California had rain in late March but remained in short termed moderate drought, with seasonal precipitation short falls of 1 to 4 inches (24-98 mm). In areas south of San Francisco, CA, March rains brought seasonal precipitation totals to about average.

<https://droughtmonitor.unl.edu>. [https://www.cpc.ncep.noaa.gov/products/global\\_monitoring/precipitation/global\\_precip\\_accum.shtml](https://www.cpc.ncep.noaa.gov/products/global_monitoring/precipitation/global_precip_accum.shtml)

### **Northwest and Washington River Discharge**

**Fraser River** discharge, measured at Hope (130 km upriver from Vancouver, B.C.), was 980 m<sup>3</sup>/s (34,608 cubic feet /sec or cfs). Late March multi-year median for Hope is 970 m<sup>3</sup>/s. <https://wateroffice.ec.gc.ca> The **Queets** at Clearwater, WA was flowing at 9,500 [3,800 cfs -historical median as cfs in brackets]. The **Puyallup** at Puyallup was flowing at 1,700 [1,780 cfs]. **Skagit** flow was 13,200 [13,600 cfs]. **Stillaguamish** discharge was 1,930 [1,940 cfs]. **Columbia** transport was 156,000 [180,000 cfs] at Vancouver, WA.

### **Oregon River Discharge**

The **Columbia** at the Dalles, OR was at 147,000 [159,000 cfs]. The **Wilson** at Tillamook was flowing at 4,520 [1,280 cfs]. At Elkton, **Umpqua** transport was 13,300 [9,870 cfs]. **Rogue** River. flow was 2,300 [3,670 cfs] at Grants Pass and 4,980 [7,220 cfs] at Agness, OR in late March.

### **California River Discharge**

The **Klamath** near Klamath was transporting 14,700 [25,100 cfs] and **Smith** discharge was 13,600 [4,840 cfs] near Crescent City. The **Eel** at Scotia had 2,150 [8,560 cfs] transport. **Battle Creek**, Coleman National Fish Hatchery flow was 454 [597 cfs]. **Butte Creek** at Chico had 202 [576 cfs] transport. **Sacramento** transport was 11,600 [24,300 cfs] at Verona and 14,600 [27,700 cfs] at Freeport. **San Joaquin** flow was 1,420 [3,190 cfs] at Vernalis. **Pescadero Creek** transport was 11.3 [39 cfs] near Pescadero. **San Lorenzo** discharge was 32 [102 cfs] at Santa Cruz. The **Pajaro** at Chittenden was flowing at 61 [85 cfs]. The **Salinas R.** near Spreckels was flowing at 74 [73 cfs]. The **Carmel**, at Carmel was flowing at 107 [121 cfs]. The **Big Sur River** near Big Sur, CA discharged at

75 [102 cfs] during the final days of March. <https://waterdata.usgs.gov/ca/nwis/current/?type=flow>  
<https://www.cnrfc.noaa.gov/awipsProducts/RNOWRKCLL.php>= (current)  
[https://wateroffice.ec.gc.ca/search/real\\_time\\_results\\_e.html](https://wateroffice.ec.gc.ca/search/real_time_results_e.html)  
[https://www.cpc.ncep.noaa.gov/products/global\\_monitoring/precipitation/global\\_precip\\_accum.shtml](https://www.cpc.ncep.noaa.gov/products/global_monitoring/precipitation/global_precip_accum.shtml)  
[https://www.nwrfc.noaa.gov/water\\_supply/wy\\_summary/wy\\_summary.php?tab=5](https://www.nwrfc.noaa.gov/water_supply/wy_summary/wy_summary.php?tab=5)

## Notes

Because of Shelter in Place (i.e. Stay at Home) instructions to curb the course of the **COVID-19 virus epidemic** in the US, Washington, Oregon and California have issued restrictions on recreational fishing in state waters. Washington first **closed recreational fishing** in all state waters on 25 March. Oregon followed with restrictions on recreational salmonid fishing on the Columbia River. California's state and local governments have also restricted recreational fishing and boat launching to limit virus transmission by interpersonal proximity. In many cases commercial fishing is not impacted except for highly variable markets, but in cases where commercial fishing is normally prohibited the recreational fishing restrictions will facilitate and possibly enhance anadromous and other fish movement that contributes to environmental balance and productivity. Each state will adjust and relax restrictions in somewhat different ways and it remains to be seen how the interplay of various fish stocks, environmental variation and ongoing fishery restrictions will affect conservation, stock enhancement and other fisheries management options. <https://myodfw.com/recreation-report/fishing-report/northwest-zone>  
<https://caseagrant.ucsd.edu/blogs/shelter-in-place-and-eat-some-fish>

An unusual period of elevated ocean temperatures occurred across the northeastern Pacific ocean during 2014–2018. The highest sea-surface temperature ever recorded in a 103-year span of continuous data collection at La Jolla, California (32.9°N) occurred during August 2018. **Poleward distributional shifts** in the geographic range of hundreds of marine organisms have been documented during or after shorter duration anomalously warm periods. A recently published paper by H. J. Walker, P.A. Hastings, J.R. Hyde, R.N. Lea, O.E. Snodgrass and L.F. Bellquist [Estuarine, Coastal and Shelf Science 236 (2020) 106634] documents the unusual occurrences of **36 fish species**, from the **Southern California Current System (SCCS)** during 2014-2018. Whale Shark, Giant Manta and Blue Marlin, unusual inhabitants of the SCCS, were observed during 2014-2018. Wahoo, Pompano Dolphinfish and Goldspotted Sand Bass were among the 14 species documented in the SCCS for first time. The authors present extensive date, location and taxonomic verification for each occurrence. Related papers include, Norton, J.G., 1999. Apparent habitat extensions of dolphinfish (*Coryphaena hippurus*) in response to climate transients in the California Current. *Scient. Mar.* 63 (3–4), 239–260 and Feeney, R.F., Lea, R.N., 2016. Records of wahoo, *Acanthocybium solandri* (Scombridae), from California. *Bull. So. Cal. Acad. Sci.* 115 (3), 198–200.  
<http://www.elsevier.com/locate/ecss>

This and past Narratives may be found, [https://coastwatch.pfeg.noaa.gov/elnino/coastal\\_conditions.html](https://coastwatch.pfeg.noaa.gov/elnino/coastal_conditions.html)  
[Jerrold.G.Norton@noaa.gov](mailto:Jerrold.G.Norton@noaa.gov) Phone:831-648-9031